

# **GLOBAL CLIMATE CHANGE:**

## **What's Happening, and What Can We Expect**

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# What is 'climate'?

- **Climate is 'average weather'**

- and its variability
- for a particular region
- over a period of time

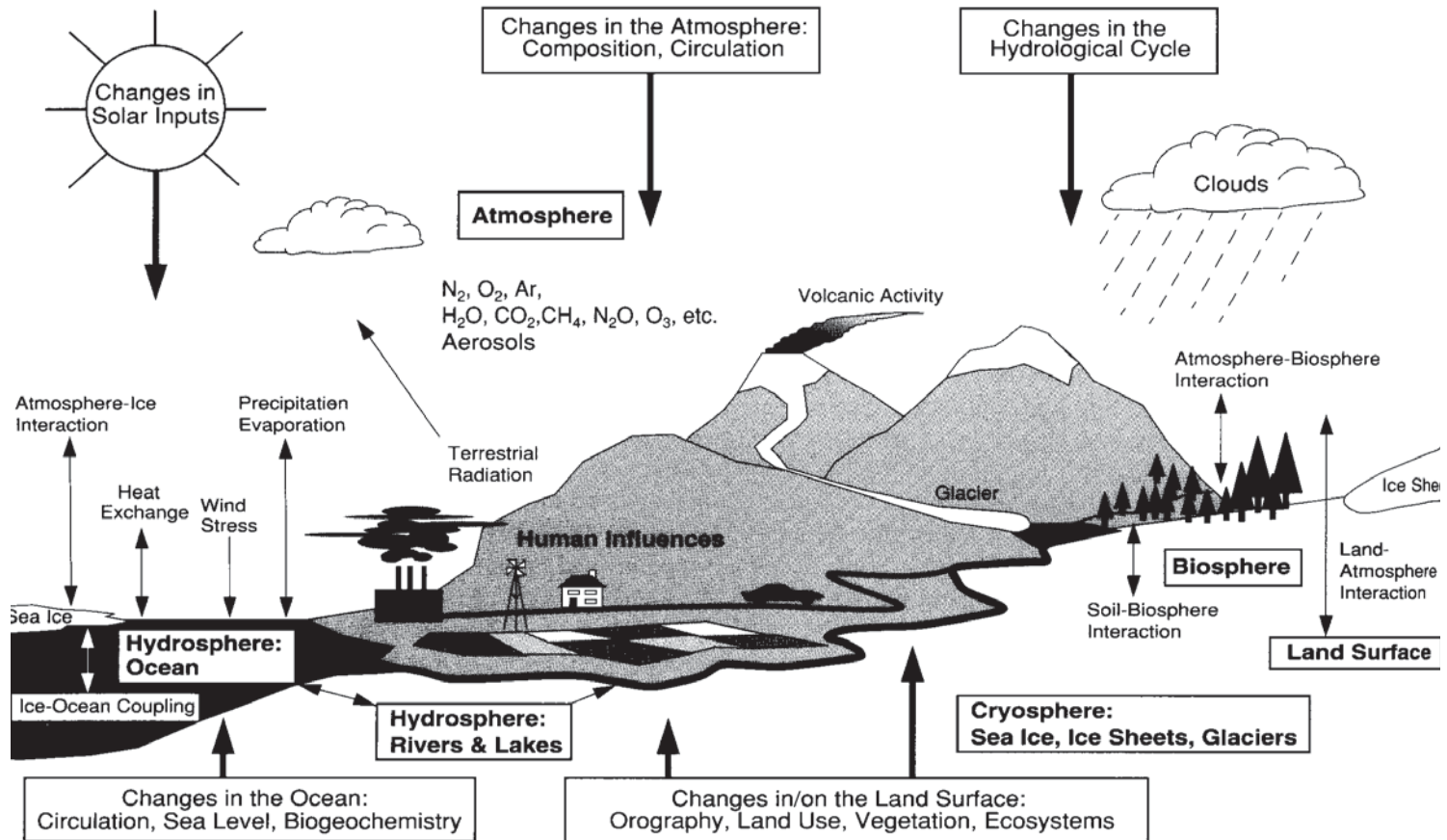
- **Includes many different elements**

- temperature
- rain/snow
- sunshine hours
- wind, etc.



Environment Canada  
www.weatheroffice.ec.gc.ca

# However, the climate system is also influenced by many other complex interactions and feedbacks





# The earth is getting warmer

## THE TOP 10

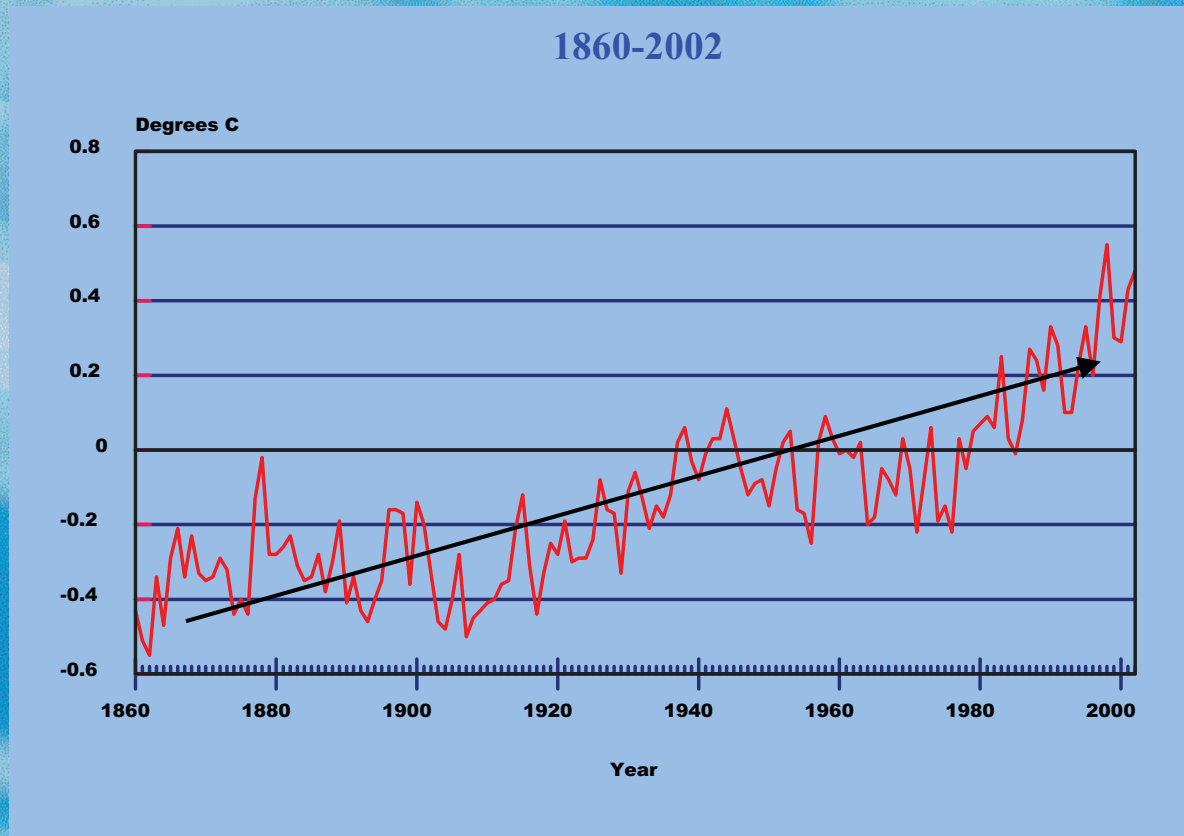
- 1: 1998
- 2: 2002
- 3: 2001
- 4: 1997
- 5: 1995
- 6: 1990
- 7: 1999
- 8: 2000
- 9: 1991
- 10: 1987

➤ 20th century the warmest globally in past 1000 years

➤ 1980s and 1990s warmest decades on record

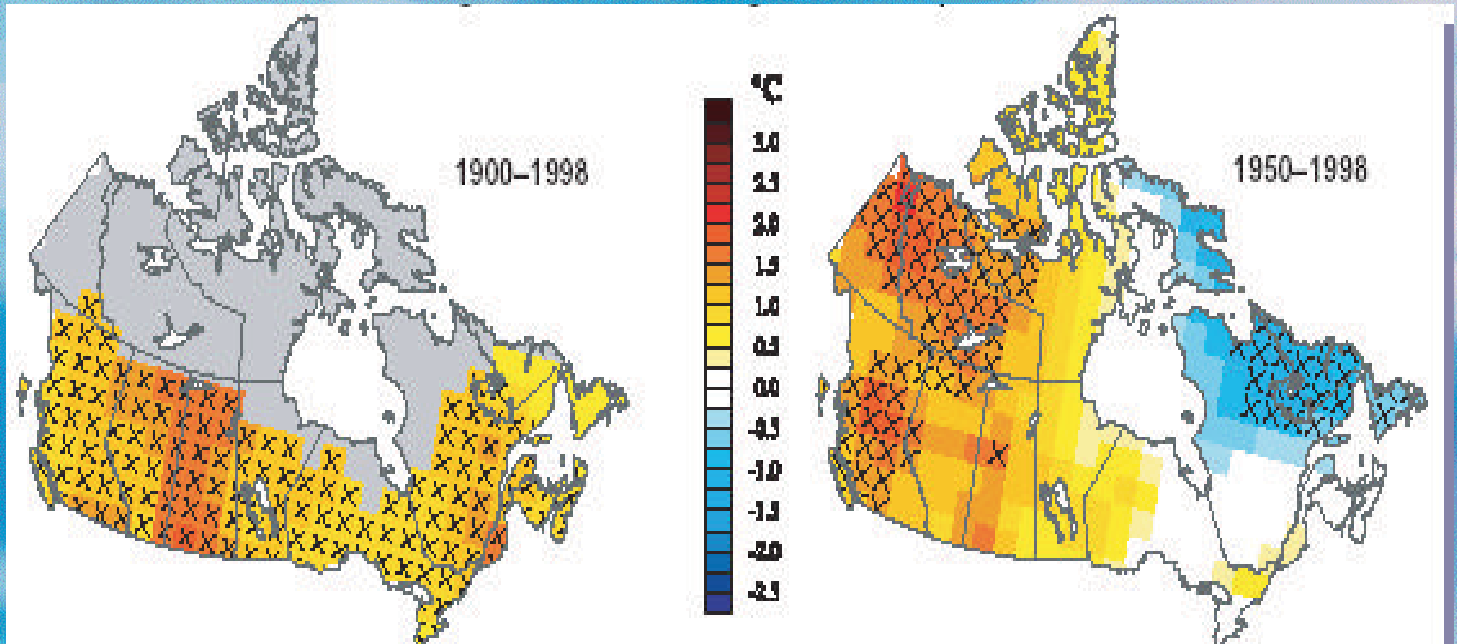


# Global surface temperatures are rising



Relative to 1961-90 average temperature

# Canadian temperatures have also increased substantially during the past century



From Zhang et al., 2000



# The warming will continue

- Scientists predict average temperature increase between 1.4 - 5.8°C in next 100 years
- Small changes in average temperatures make a big difference:
  - ✓ Average temperatures today are only about 5°C warmer than they were during the last Ice Age



# Temperature changes will vary

- Temperature changes in Canada won't be uniform
- Polar regions will warm more than mid-latitude regions
- The Atlantic will cool slightly

# How do we know this is happening?

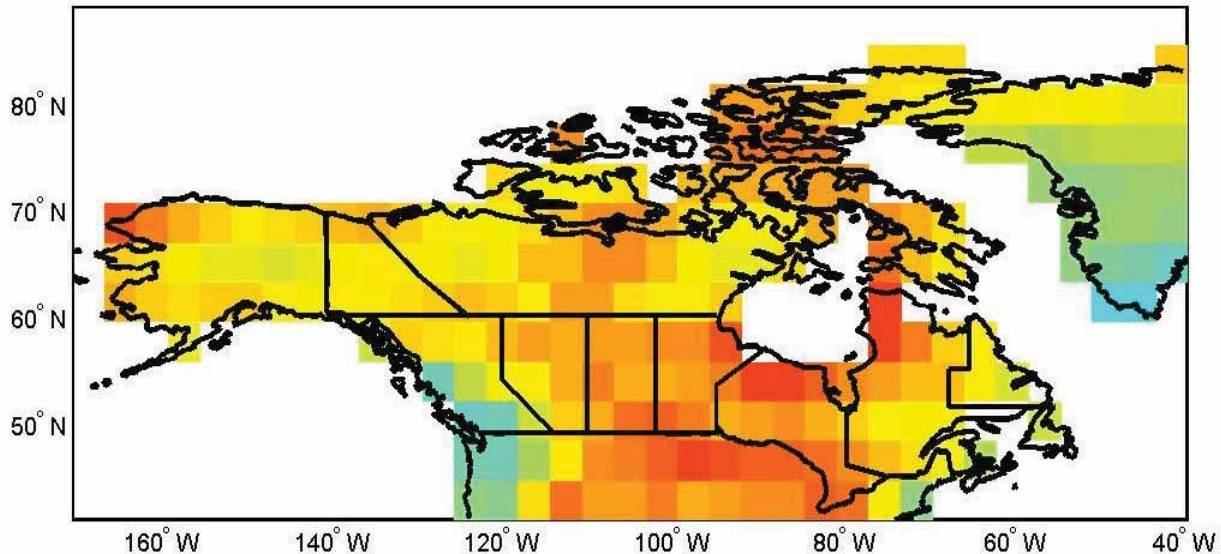


- Instrumental records - to 1860
- Ice cores, sediment cores, tree rings, historical records, traditional knowledge - evidence dating back several thousand years
- Satellite mapping & computer modelling for future predictions: Canadian model one of the best

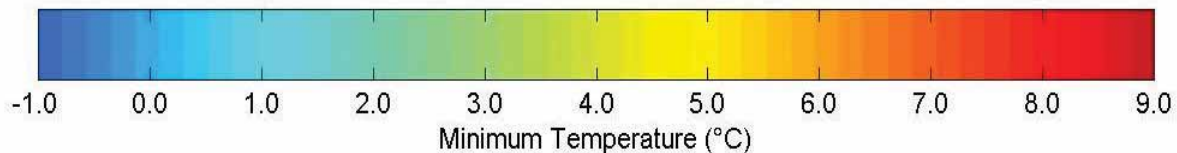




# Climate Change Modeling: Possible Future



**CGCM1, Mean Winter Temperature Change 2050**

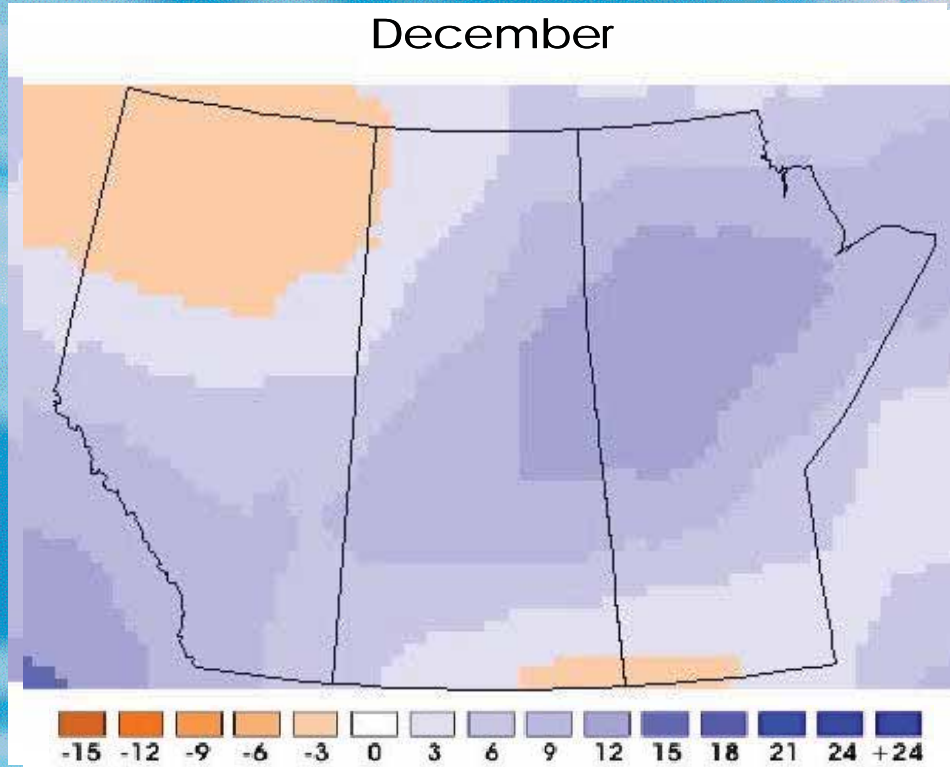




# 2050 Monthly Precipitation Scenarios

% Change

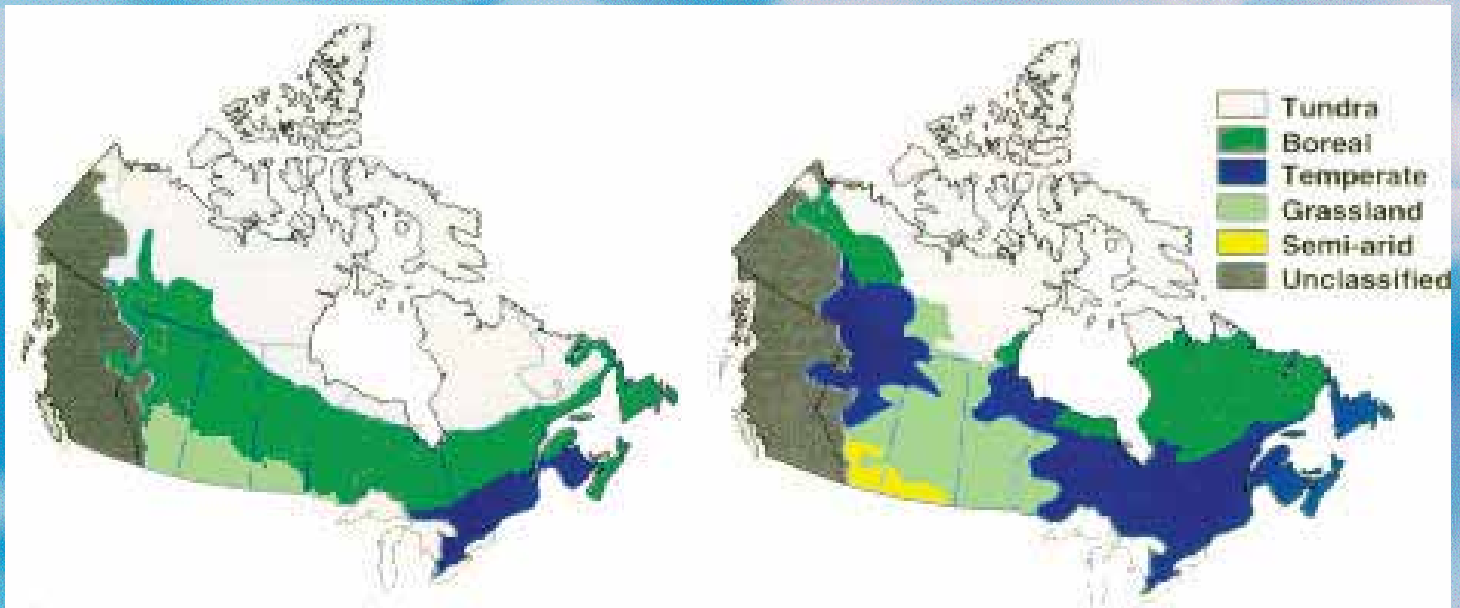
December




# Possible Changes in Canada's Ecozones with 2x CO<sub>2</sub> Levels

Present Day

Year 2060



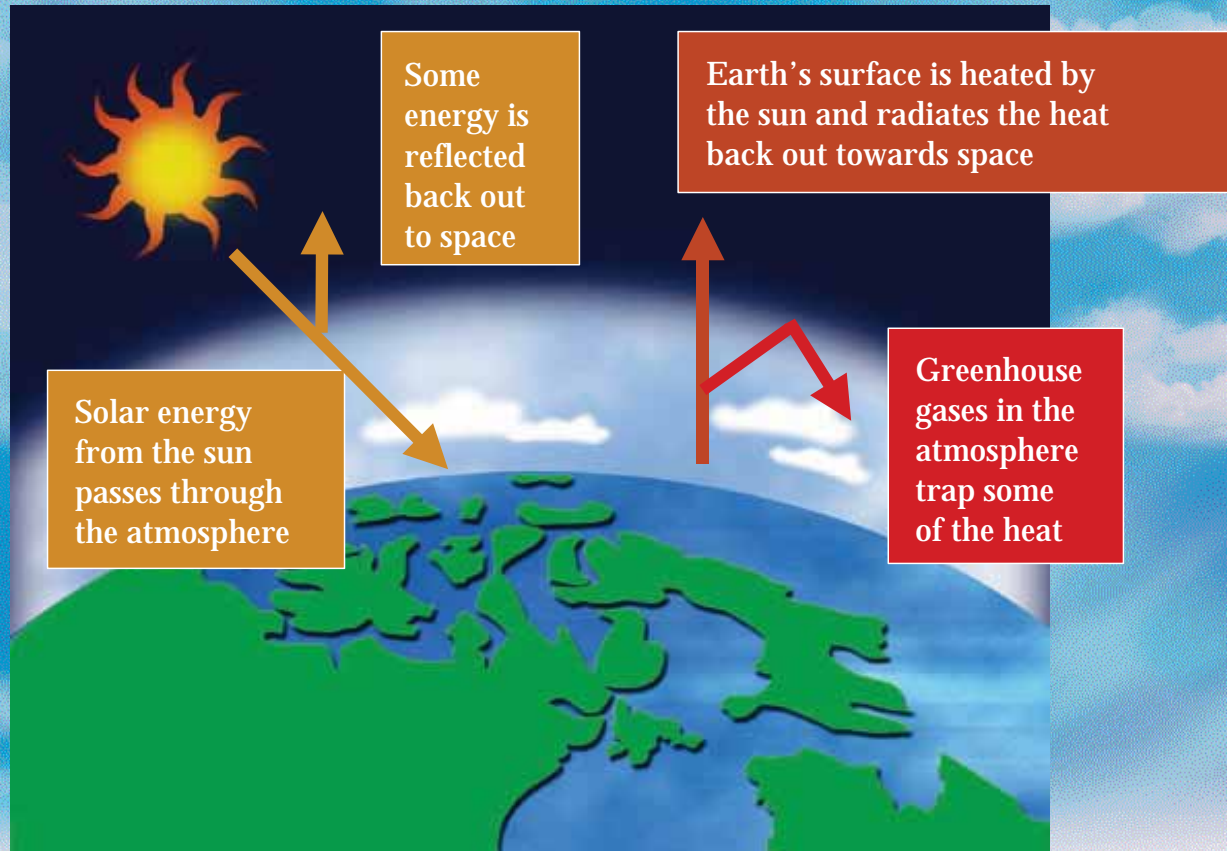




Why is this  
happening?



# The greenhouse effect





# What are the greenhouse gases?

## Water vapour:

The most common gas



## Carbon dioxide:

Released through burning  
Fossil fuels

## Methane:

From wetlands, rice paddies,  
animal digestive processes,  
landfills and sewage treatments



## Nitrous oxide:

From soils and the ocean  
Agriculture fertilizers

## Ozone:

Exists naturally in the  
upper atmosphere



## Halocarbons:

Human-made chemicals





“ There is new and stronger  
evidence that most of the  
warming observed over the  
last 50 years is attributable  
to human activities. ”

Intergovernmental Panel on Climate Change  
2001



# Human activities are intensifying the greenhouse effect

Electricity



Deforestation



Industry



Transportation





# Global trends in fossil fuel CO<sub>2</sub> emissions



Source: <sup>1</sup>1999: Marland, G. et. al., Oak Ridge National Laboratory,  
U.S. Department of Energy,  
Oak Ridge, Tenn., USA.  
[http://cdiac.esd.ornl.gov/trends/emis/tre\\_glob.htm](http://cdiac.esd.ornl.gov/trends/emis/tre_glob.htm)





What's wrong  
with  
**warmer**  
temperatures?



## Potential benefits to Canadians include:

**Lower snow  
removal costs**



**Less ice cover  
on Great Lakes,  
along east coast,  
and Arctic**



**Longer, warmer  
growing seasons**



**Lower  
heating costs**

# Potential impacts of climate change on Canada

## The North



## The Prairies



British  
Columbia



Ontario and Quebec



Atlantic Canada



# Lower lake/stream levels have important impacts:

- Inaccessible docks
- Navigation hazard
- Degraded water quality



- Reduced hydropower



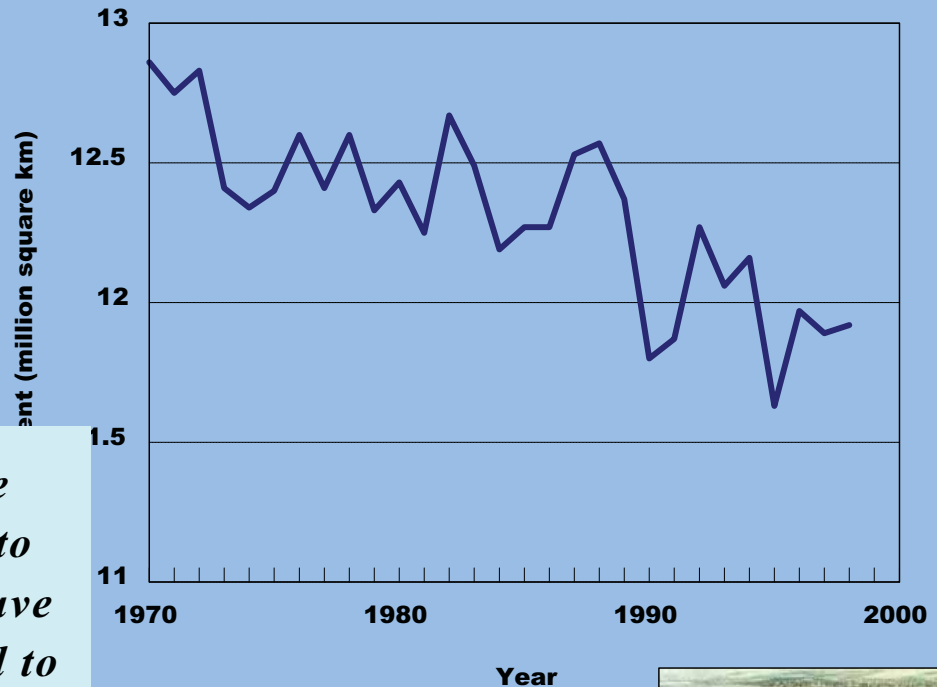
- Reduced cargo loads



# Arctic Ocean sea ice is less extensive

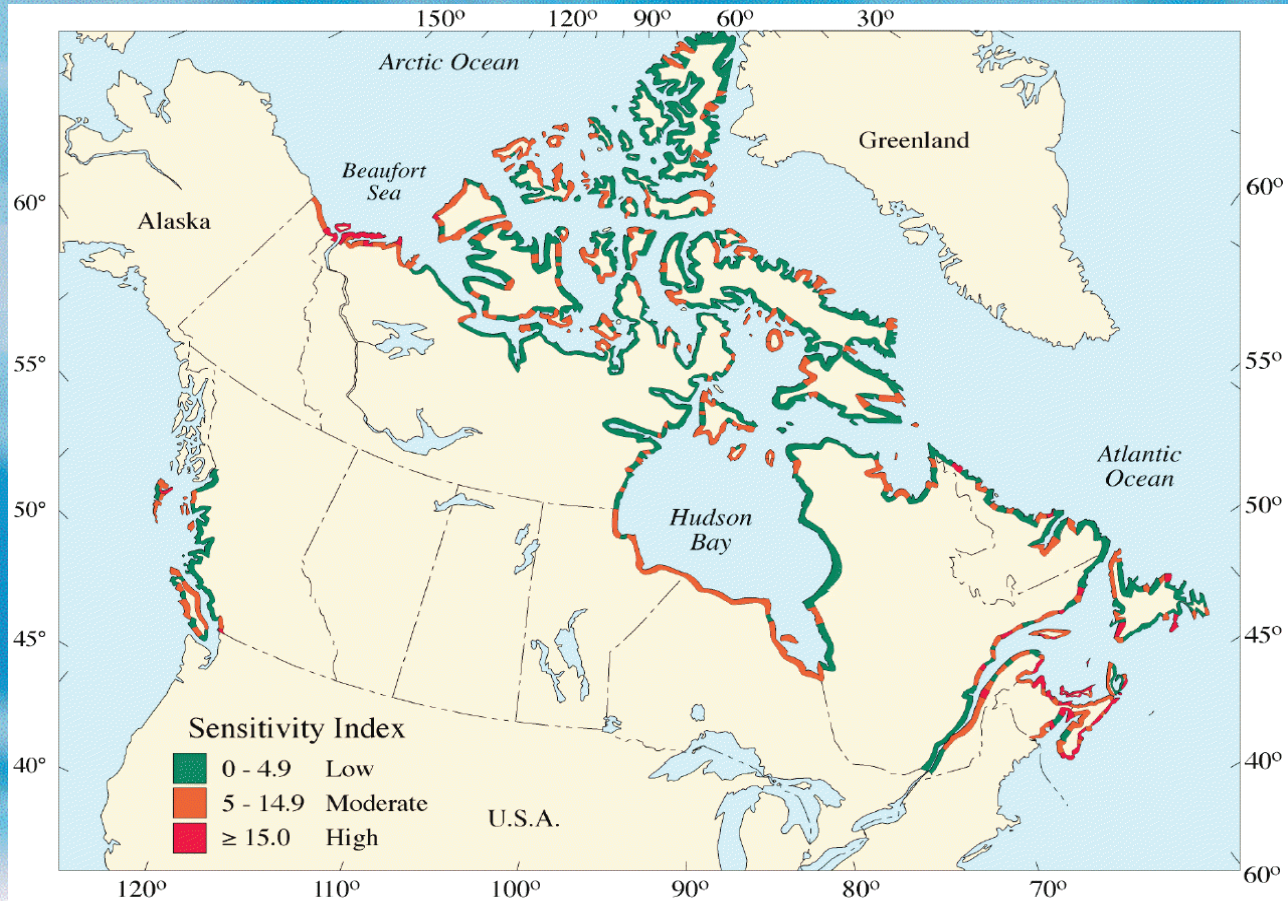


*“ We used to go on the sea ice with dog sleds to hunt seals –now we have to use boats....We used to go a long wayout – now we hunt close to shore. ”*





# Many regions of Canada's coastline are sensitive to sea level rise



**The frequency and severity of droughts are also likely to increase in southern Canada**

➤ **SOUTHWEST MANITOBA, 2003**

➤ **CENTRAL AND NORTHERN MANITOBA, 2003**

➤ **SOUTHERN ALBERTA AND SASKATCHEWAN**

➤ **SOUTHERN B.C.**







...but very wet seasons  
may also become  
more frequent or  
more frequent  
intense rainfalls - local floods



**Southeast  
Manitoba**

**June 12-  
16, 2002**

- 240 mm in  
1 hour near  
border
- 133 mm in  
Steinbach



**Vanguard, SK July 3, 2000**

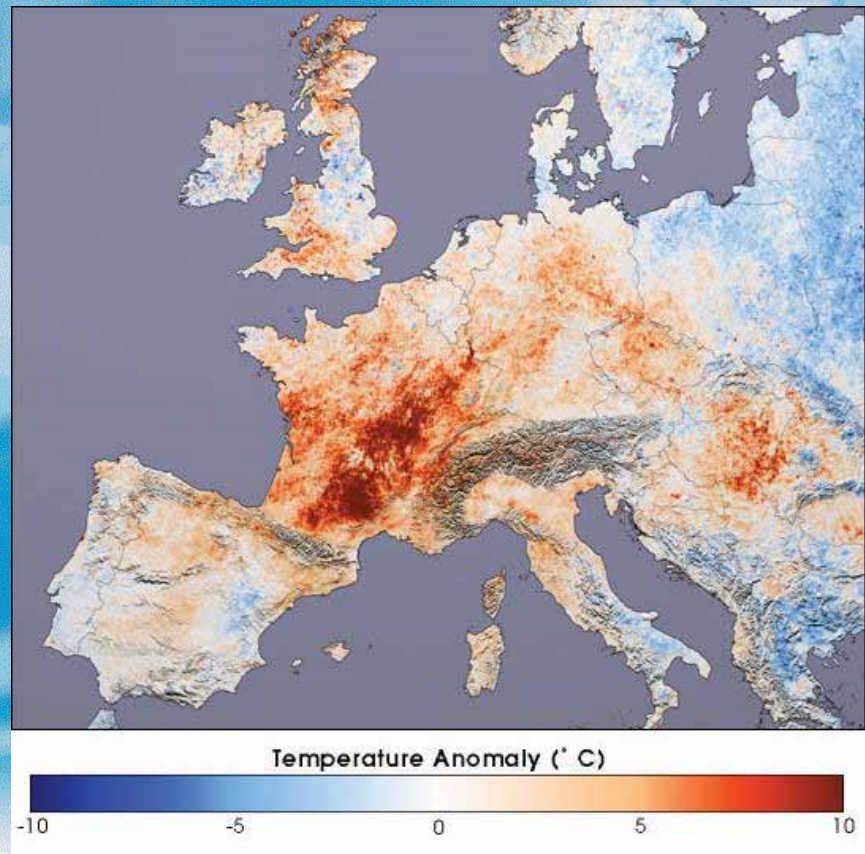
- eight-hour: 334-387 mm



# Longer, more intense heat waves HEAT STRESS

## Europe 2003

- 100°F for weeks
- 35,000 deaths





# There are also risks of the spread of diseases



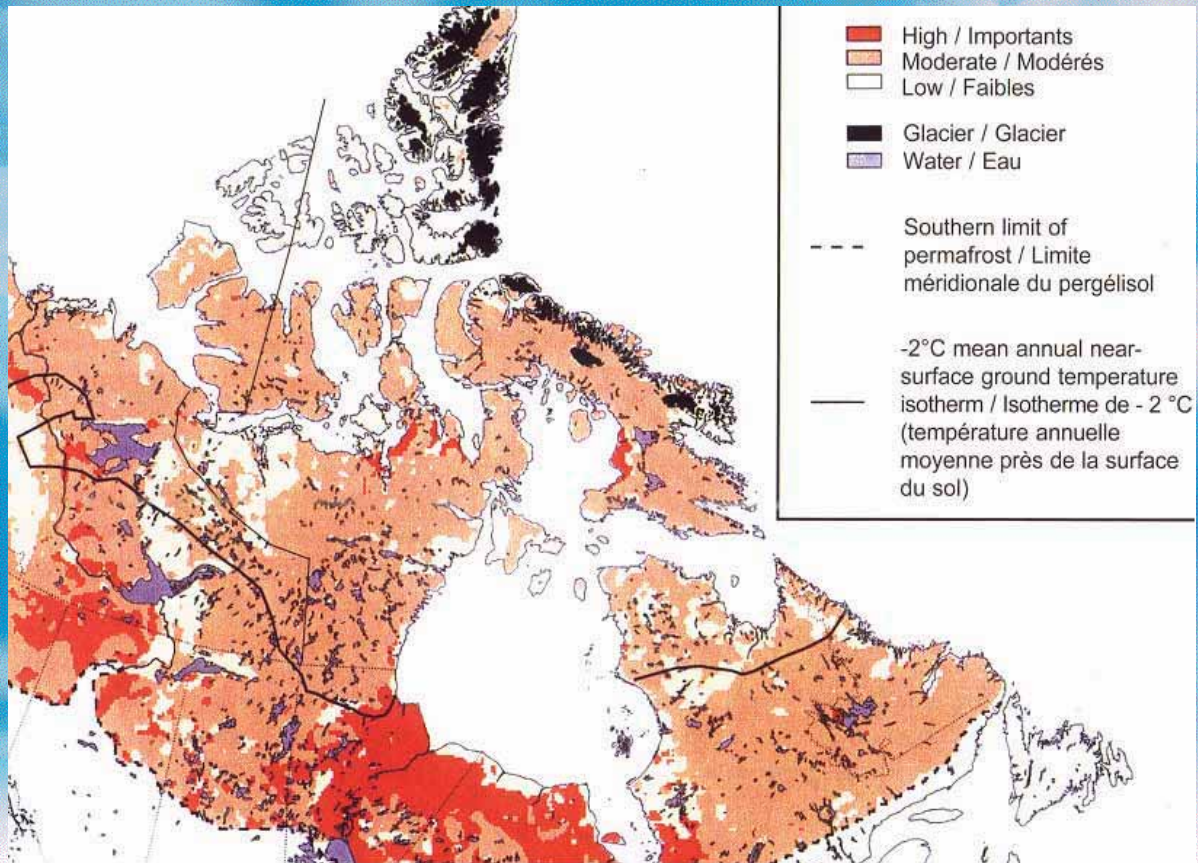
**West Nile Virus**



**Lyme Disease**



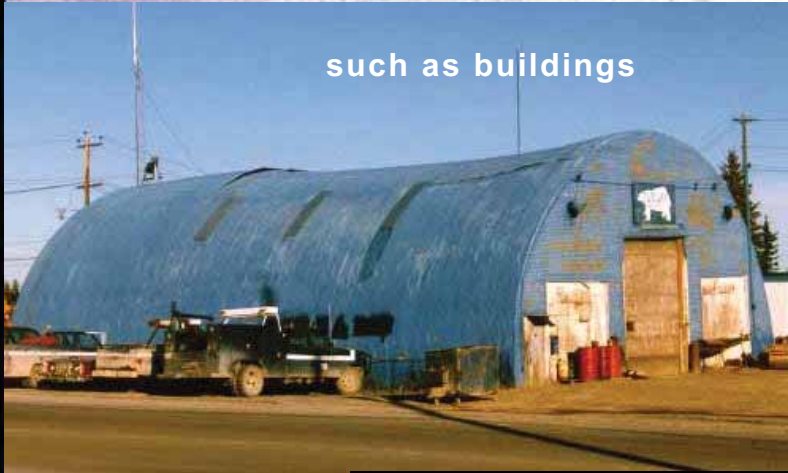
# The North: Much of Canada's permafrost is highly sensitive to changes in climate



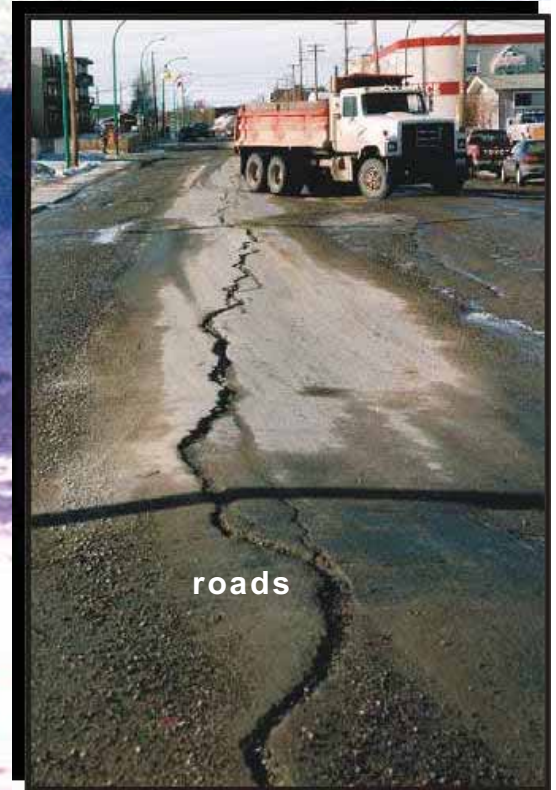


# Increase in land instability may have large impacts on human structures

such as buildings



roads



and pipelines





# Manitoba Impacts

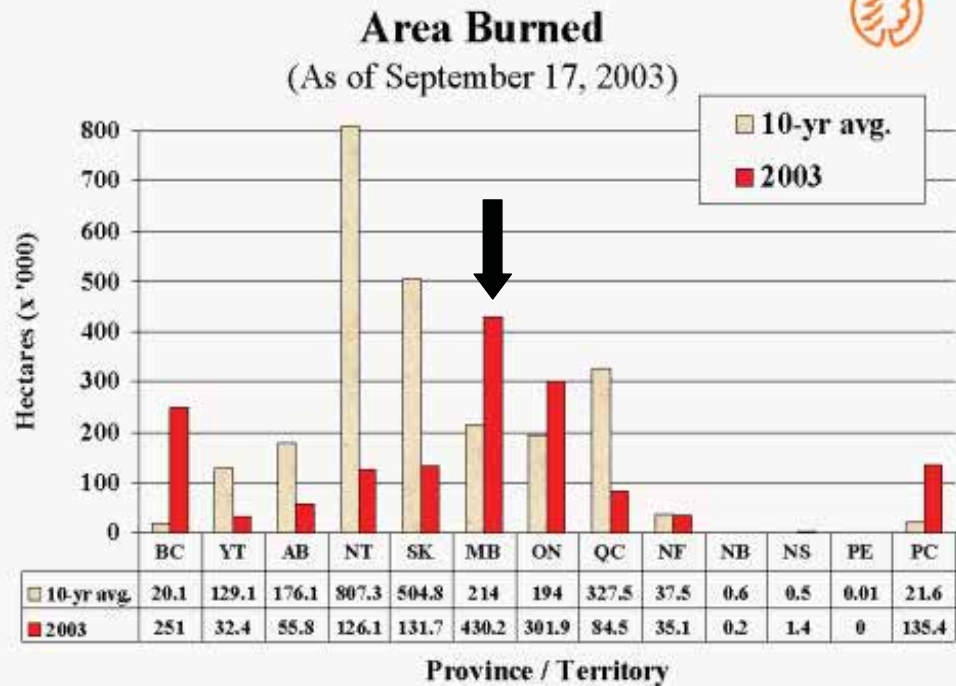
- Millions \$ in costs already due to unreliability of **winter ice roads** for northern community access
- Millions \$ more in costs now to develop land based winter road system with river crossings





# Manitoba Impacts

- Increased risk of **forest fires** (1148 fires in 2003 and largest area burned in Canada)



Averages are for August 29

Natural Resources Canada

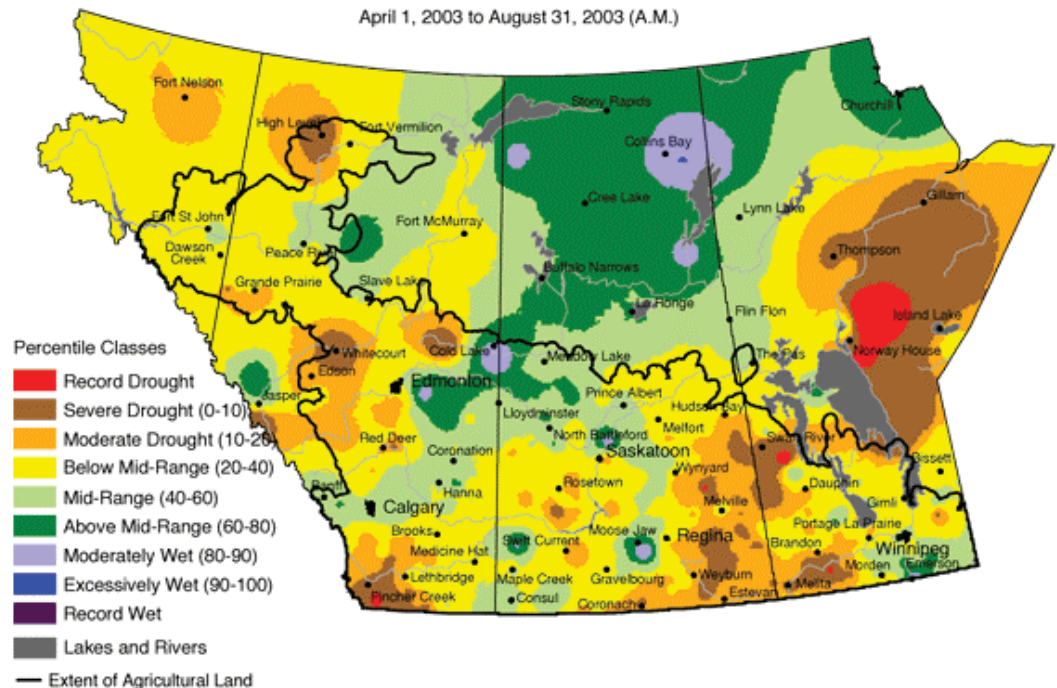


# Manitoba Impacts

- Increased risk of drought
- Risk of decreased soil moisture

## Current Precipitation Compared to Historical Distribution

April 1, 2003 to August 31, 2003 (A.M.)



Prepared by PFRA (Prairie Farm Rehabilitation Administration) using data from the Timely Climate Monitoring Network and the many federal and provincial agencies and volunteers that support it.



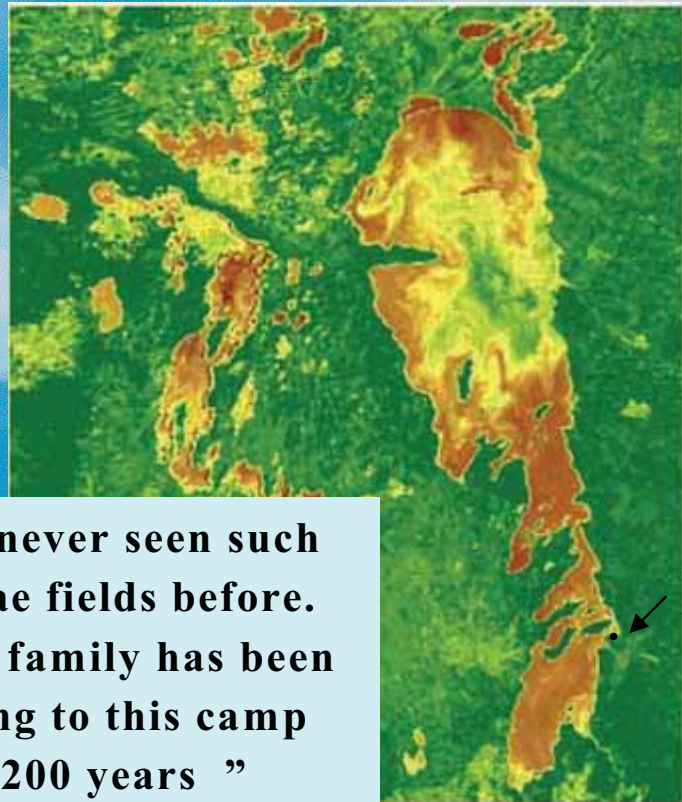
# Manitoba Impacts

## Lake Winnipeg

- Water levels
- Water temperature
- Algae blooms
- Fish species change

**“ ...saw reefs I  
never saw before ”**

**“ I never seen such  
algae fields before.  
My family has been  
going to this camp  
for 200 years ”**



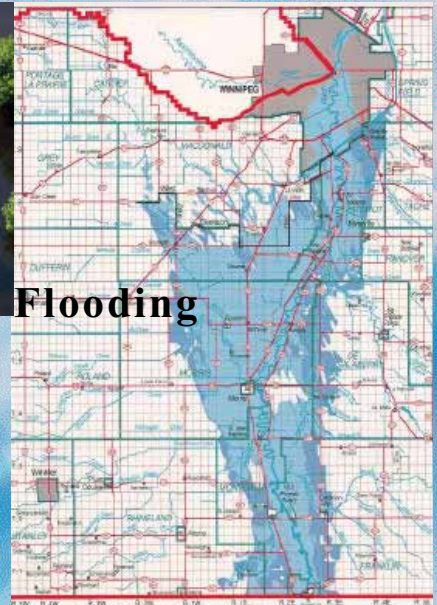
**Hollow  
Water**



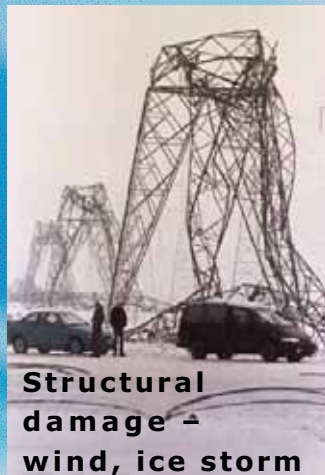
# Manitoba Impacts

Increased risk of more frequent  
and large magnitude severe storms  
and related damage

**Lightning damage**



**Flooding**



**Structural  
damage –  
wind, ice storm**



**Ecological  
disaster**

**RED RIVER VALLEY**  
AREAS FLOODED BY THE RED RIVER  
IN 1950 AND 1997



# The international response

- In 1992, Canada and 154 others signed the UN Framework Convention on Climate Change
- Canada one of 160 signatories of 1997 Kyoto Protocol to UNFCCC
- Target: reduce GHG emissions to 6% below 1990 levels during 2008-2012 (240 MT reduction target annually)
  - Manitoba target: 23% below 1990 levels



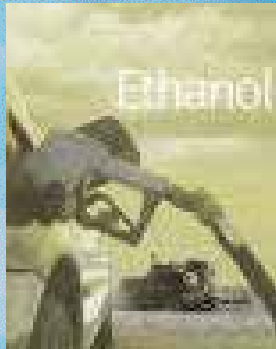
# How does Canada compare?

- Canada is responsible for 2.5% of international GHGs.
- 3rd-largest emitters per capita, after U.S. & Australia





# What Manitoba is doing...



**Ethanol and  
biofuels**



**Low-impact hydroelectric  
generation** (Wuskwatim, Gull, Conawapa)

■ Clean power exports to Ontario

**Hydrogen Fuel**



**Wind Power**

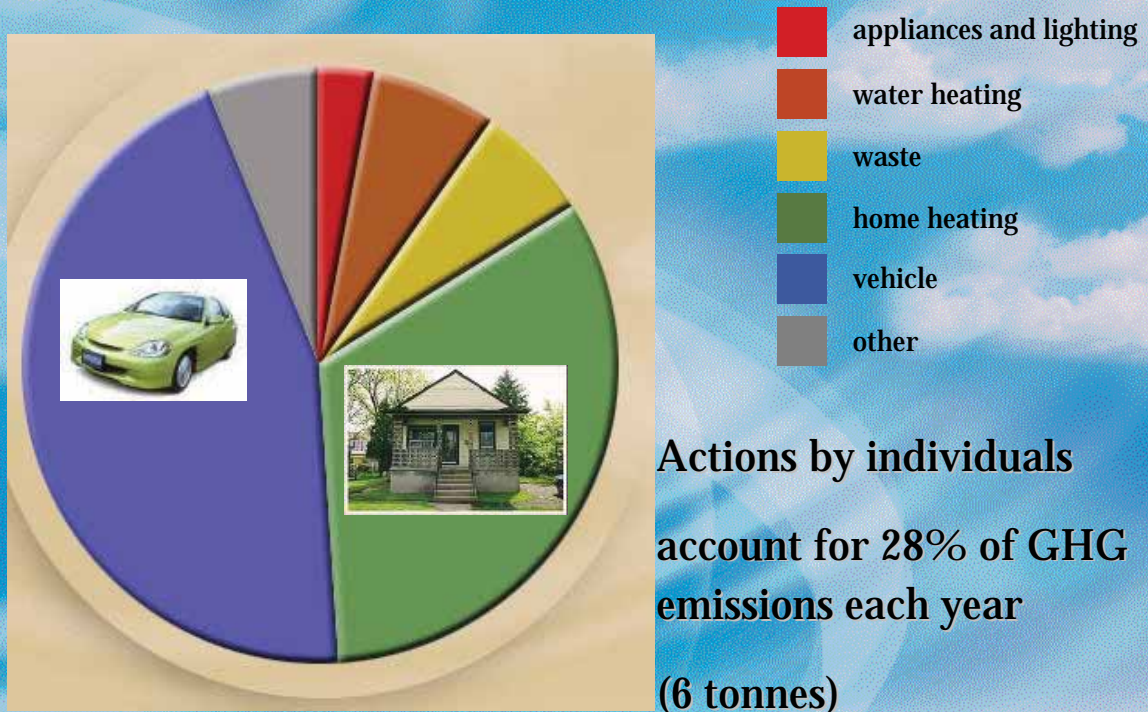


YourQuest

POWER FOR GENERATIONS TO COME



# Personal GHG Emissions

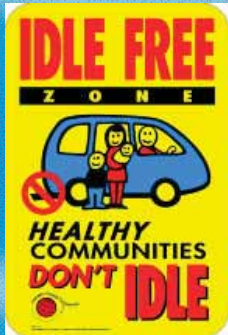




# What can I do?

- Taking action to reduce emissions will slow the rate of climate change, save money and produce other environmental and health benefits.

Do not idle  
your vehicle



Recycle or  
compost

Turn off lights  
and electrical  
appliances



Make your  
home more  
energy-  
efficient

Plant trees







**Thank you**

**Questions?**



# Current NH temperatures are very unusual within at least the past 1000 years *optional slide*

